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(54) Time slot management system

Verwaltungssystem von Zeitschlitzen

Système d'attribution d'unités temporelles

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Description

The present invention relates to a time slot management system for a digital time division multiple access system including a main station coupled to each of a plurality of substations via the cascade connection of a common transmission link and an individual user link, said management system being able to allow each of said substations to transfer upstream information packets to said main station in time slots.

Such a management system is already known in the art, e.g. from the document "International Conference on Integrated Broadband Services and Networks 1990; 15 - 18 OcT. 1990, London, UK; pages 58 - 62; J.W. Ballance et al. : 'Access Netwoqrks - Beyond MANS to Solutions compatible with B-ISDN'". Therein a functional description is given of a management system controlling the transfer of information packets in a star network in which a plurality of user stations are connected via user links to a central star node. One of the user stations operates as main station, called Present Supervisory Control (PSVC) station and its link to the central star node may be considered as the above common link. The time slots used for upstream communication are taken into account for possible changes in the bandwidth required by the substations to send the upstream packets.

The management system assigns the mentioned time slots in a flexible way, i.e. it takes into account the above mentioned changes.

Part of said time slots are dedicated for upstream transfer, from said user stations to said main station, of information concerning the bandwidths required for further transfer of upstream information packets by these stations, said time slot management system including a registration means to store for said user stations values indicative of said bandwidths and a conversion and transmission means to convert said values to corresponding occurrences of identitities in a stream of station identities and to transmit said stream of identities in downstream information packets to said user stations each of which upon detection of its own identity in said stream being allowed to transfer a predetermined amount of upstream information packets.

In this way the time slots in which each user station can send upstream information packets are determined by the transferred stream of station identities and the stream of station identities is derived from the stored bandwidth values which are regularly adapted according to the bandwidth information sent from the user stations to the main station by means of the reserved time slots, each of these values being converted in a corresponding number of time slots. As a consequence the mentioned time slots are allocated in a flexible way with respect to the bandwidth required for the transfer of the upstream information packets.

An object of the invention is to provide a management system of the above known type but which provides an improved overhead of the downstream information packets. This object is achieved by means of a management system of the above type but wherein said downstream information packets include a predetermined number of blocks each of which includes a header part and an information part, the identities of said stream being distributed over the header parts of said blocks.

A feature of the invention is that each of said header parts is 1 byte long, whilst said predetermined number equals 4, synchronization information, the identity of 4 user stations and error check information being distributed over the 4 headers of each of said downstream information packets, which implies a packet-overhead of 4 bytes for 4 ATM cells. Since each ATM cell contains 53 bytes, this means an overhead of above 2% where it can be calculated that the existing system works with a package or frame overhead of about 7%. In the known system, which has a data rate of 32 Mbit/s, the maximum frame time is indeed about 70 ms whilst the 127 use stations transmit 2048 byte data packets, which corresponds to a time of 65 ms, i.e. an overhead of 5 ms for 70 ms or 7%. Moreover this overhead increases with the distance between the user stations due to the use of slot intervals.

The above mentioned and other objects and features of the invention will become more apparent and the invention itself will be best understood by referring to the following description of an embodiment taken in conjunction with the accompanying drawings wherein :

Fig. 1 represents a communication system using a time slot management system TSM according to the invention;
Fig. 2 is a schematic representation of the time slot management system TSM of Fig. 1; and
Fig. 3 represents the contents of a downstream information packet transferred by the communication system of Fig. 1.

The present time slot management system TSM is part of a communication system which is shown in Fig. 1 and which is a point-to-multipoint system. This system is able to transmit packets containing Asynchronous Transfer Mode (ATM) cells at a rate of 155.52 Mbit/s, and comprises a main station MS that is connected to 16 user stations U1/16 via the cascade connection of an optical fiber common link 1c, and respective individual user optical fibre links 11 to 116.

The main station MS has an input terminal I to which is connected a (not shown) interworking unit providing for instance an interface to a local exchange. MS also has an output terminal 0 connected to the common link 1c.

The packets with ATM cells are transmitted in time slots from the user stations U1/16 to the main station MS, i.e. in upstream direction, and vice versa, i.e. in downstream direction. The main station MS, and more specifically the time slot management system TSM in-

cluded therein, controls the upstream communication in a flexible way by dynamically assigning time slots to each of the user stations U1/16 to enable them to transfer upstream information packets.

TSM, of which a schematic and functional diagram is shown in Fig. 2, includes a registration circuit R which is able to store values indicative of information concerning the bandwidth, required by the user stations for upstream communication and extracted from management packets sent by these user stations U1/16 to the main station MS. How this is achieved will be explained later. R has an input to which an output of an input/output module I/O is connected via a microprocessor circuit MC, and 16 control outputs each of which is coupled to a respective one of 16 cyclic counter circuits T1/16 forming part of a conversion circuit C. An output of each of these counter circuits T1/16 is connected to a respective input of a multiplexer circuit MUX also included in C. An output of MUX is via a first-in-first-out FIFO queueing circuit Q coupled to a packet formatting module F which realizes the encapsulation of the ATM cells to be sent to the user stations, in the downstream packets. F has a second input I' at which the latter cells are applied, a third input to which the microprocessor circuit MC is connected and an output coupled to the output terminal 0 of the main station MS via the input/output circuit I/O.

Following is with reference to Figs. 1 and 2 a description of the working of the time slot management circuit TSM.

The microprocessor circuit MC periodically applies command signals to the packet formatting module F which in response to each such signal generates a downstream packet with a management ATM cell and transmits this packet to the user stations U1/16. This downstream packet contains the identity of a user station for which the management ATM cell is intended. Upon receipt of such a management cell and detection of its identity a user station is allowed to send in a following time slot the peak rate at which it intends to perform upstream packet transfer, i.e. a value indicative of the bandwidth required for this transfer. The downstream packets will be described in more detail later.

When the packet rate information is received by I/O it is transmitted to the microprocessor circuit MC which extracts from it the packet rate and transmits this information to the registration circuit R wherein it is converted and stored, the converted value being the inverse of the rate i.e. the period between 2 consecutive upstream packets, thereby possibly overwriting a previously stored value. This above period is expressed in time units provided by a packet clock (not shown) in the main station.

To be noted that the user station can also send the inverse of the required bandwidth to the main station, in which case that information is stored by R as such.

Each of the cyclic counter circuits T1/16 is associated to a corresponding one of the user stations U1/16, e.g. T1 is associated to U1, T2 to U2, etc., and has an identity which corresponds to the identity of the user station to which it is associated. Starting from a maximum value the cyclic counters T1/16 count down and generate a zero indication trigger signal when reaching zero, whereafter the count is restarted. The maximum value is the period value stored in the registration circuit R for the associated user station. The latter circuit R presets the counters T1/16 to their corresponding maximum value, i.e. the corresponding stored value, each time the latter value is adapted. The counters count down at the rhythm of the above packet clock in the main station MS. This clock is extracted in the user stations U1/16 from the information packets sent thereto by the main station and is used as local clock. In this way the peak rate information sent to the main station can be expressed in the same time unity as provided by the packet clock and consequently each counter circuit counts the number of time units in a period i.e. the time elapsing between the requested sending of two consecutive packets by the associated user station. The multiplexing circuit MUX successively scans the outputs of the counter circuits T1/16 and generates at its output a signal indicative of the identity of a scanned counter only when it detects the above trigger signal.

The scanning of all counter outputs is realized within 1 upstream packet period to avoid that a zero indicating trigger signal provided by one of the counters T1/16 overwrites a previous one before the latter is detected by the multiplexing circuit MUX. A latching circuit (not shown) ensures that the zero indicating signal remains at the corresponding output during the latter packet period.

The thus generated identities are stored in the FIFO queue Q from where the first four are retrieved periodically, at the rate of the downstream transfer, by the packet formatting module F which inserts them in a downstream information packet. In case there are less than 4 identities available in the FIFO queue Q, dummy or zero identities are used to complete the set of 4 identities.

It has to be noted that the conversion circuit can also be realized by means of a software program and a processing unit or by hardware arithmetic implementations.

Fig. 3 represents the mentioned downstream information packet. It consists of 4 blocks each having a header part H1/4 and a respective information part A1/4 containing an ATM cell. The four identities, TEA1/4, also called Transmit Enable Addresses, which are either user station identities, retrieved from Q or null-identities, are distributed over the 4 header parts H1 to H4 together with synchronization information CPA and error check information CRC as shown in figure 3, i.e. CPA which is 3 bits long and the first 5 bits of TEA1, which is 6 bits long, are stored in H1; the last bit of TEA1, TEA2 and the first bit of TEA3 are stored in H2; the last 5 bits of TEA3 and the first 3 bits of TEA4 are stored in H3 and the last 3 bits of TEA4 and CRC form H4.

The 4 ATM cells stored in A1 to A4 are provided at the input I' of F or provided by the microprocessor circuit MC in case the earlier mentioned management cells have to be transmitted and they are destined to the user station having the identity TEA1/4 respectively. The cells provided at I' are extracted from a signal provided by the earlier mentioned interworking unit at the input I of the main station. Since this extraction is not relevant for the invention it is not described in detail, nor are the functional blocks required therefore represented in Fig. 1. An indication of their presence is given by the dotted line between I and I'.

The distinction between an information packet containing a management ATM cell and the one containing an ATM cell provided at I' is made by a dedicated address field, more specifically a VP/VC field, in the header of a dedicated address field, the ATM cell which is contained in the information part A1/4. The management packets are under control of the microprocessor MC transferred periodically at a rate of 1 every 53 ATM cells.

The downstream packet generated by F as described above is provided at the output 0 via the input/output device I/O and is transferred to the user stations U1/16, where each station, based on the identity TEA1/4 included in the packet extracts from it the information intended for itself and derives from that information the instant at which an upstream packet may be sent to the main station MS. For instance, if TEA2 is the identity of U5, then U5 may send an upstream packet after receipt of the complete downstream packet containing TEA2. A user station detecting its identity in a received packet, has, when sending an upstream packet, to take into account its equalization delay plus n times an upstream packet period where n equals 0,1, 2 or 3 according to the user station's identity being respectively equal to TEA1, TEA2, TEA3 or TEA4. This to avoid collision on the common link 1c with an upstream packet sent by any of the three other user stations of which the identity is included in the same received packet. In the above example U5 waits, after receipt of the downstream packet including its identity, for its equalization delay plus 1 upstream packet period before sending an upstream packet. How the equalization delay is determined is for instance described in the not yet published European Patent Application 91201355.4.

At start up of a new user station, the equalization delay thereof is determined for the first time by means of a ranging procedure described in the above patent application. When the latter procedure is completed the main station allocates a station identity to the new station and informs it thereof via a signal similar to the ranging signal used in this procedure. From that moment on the new user station is able to extract from the downstream packets, ATM cells destined to it. The first cell sent to the new user station by the main station is a management cell, thereby enabling the latter user station to inform the main station about its peak transmission rate.

It has to be noted that if either the main station MS or the user stations U1/16 have no ATM cells to transfer, they insert an idle cell in the downstream and upstream packets respectively.

The functional blocks of the time slot management system described above are either obvious to realize for a person skilled in the art or are generally known in the art and are therefore not described in detail.

While the principles of the invention have been described above in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

Claims

1. Time slot management system (TSM)for a digital time division multiple access system including a main station (MC) coupled to each of a plurality of substations (U1/16) via the cascade connection of a common transmission link (lc) and an individual user link (11/16), said management system (TSM) being able to allow each of said substations (U1/16) to transfer upstream information packets to said main station (MC) in time slots, part of said time slots being dedicated for upstream transfer, from said user stations (U1/16) to said main station (MC), of information concerning the bandwidths required for further transfer of upstream information packets by these stations, said time slot management system (TSM) including a registration means (R) to store for said user stations (U1/16) values indicative of said bandwidths and a conversion and transmission means (C) to convert said values to corresponding occurrences of identitities in a stream of station identities and to transmit said stream of identities in downstream information packets to said user stations (U1/16) each of which upon detection of its own identity in said stream being allowed to transfer a predetermined amount of upstream information packets, **characterised** in that said downstream information packets include a predetermined number of blocks each of which includes a header part (H1/4) and an information part (A1/4), the identities of said stream being distributed over the header parts (H1/4)of said blocks.

2. The time slot management system (TSM)according to claim 1, characterized in that each of said user stations (U1/16) upon receipt of its identity waits during a predetermined time interval equal to the time needed to transfer a packet from said user station to a fictive user station situated at the maximum distance from said main station (MC), and then transmits said upstream information packet using the n th following time slot, n being determined by the order of occurrence of said identity in said stream of identities.

3. The time slot management system (TSM) according to claim 1,characterized in that it is located in said main station (MC) .

4. The time slot management system (TSM)according to claim 1,characterized in that said conversion means (C) includes:

   - a plurality of counter means (T1/16) each of which is dedicated to one of said user stations (U1/16) and has an identity indicative of the identity of said user station, said counter means (T1/16) each having an output at which, under control of said registration means (R), a trigger signal is generated when the corresponding user station is allowed to request access to its individual user link; and
   - a multiplexing means (MUX) to successively scan said outputs and when said trigger signal is present at said scanned output to include in said stream the identity of the counter means corresponding to said output.

5. The time slot management system (TSM) according to claim 4,characterized in that said counter means (T1/16) each includes a counter circuit which is controlled by said registration means to count down starting from a maximum value based on said stored value or to count upwards from a zero value to said maximum value.

6. The time slot management system (TSM) according to claim 1,characterized in that said time slot management system also includes :

   - a queueing means (Q) to queue said stream of identities;and
   - a packet formatting means (F) to distribute a plurality of said identities, after retrieval from said queueing means, over said header parts (H1/4),said plurality corresponding to said predetermined number of blocks.

7. The time slot management system (TSM) according to claim 1,characterized in that each of said header parts (H1/4) is 1 byte long, whilst said predetermined number equals 4, synchronization information (CPA), the identity of 4 user stations (TEA1/4) and error check information (CRC) being distributed over the 4 headers of each of said downstream information packets.

8. The time slot management system (TSM) according to claim 1, characterized in that said communication system is an optical communication system.

9. The time slot management system (TSM) according to claim 1, characterized in that each of said upstream information packets and of said information parts (A1/4) includes at least one Asynchronous Transfer Mode cell.

Patentansprüche

1. Zeitschlitz-Managementsystem (TSM) für ein digitales Zeitmultiplexsystem, das eine Hauptstation (MC) umfaßt, die über die Kaskadenschaltung einer gemeinsamen Verbindungsleitung (lc) und eine einzelne Anwenderverbindungsleitung (l1/16) an mehrere Substationen (U1/16) gekoppelt ist, wobei das besagte Managementsystem (TSM) in der Lage ist, jeder der besagten Substationen (U1/16) zu erlauben, in Zeitschlitzen Datenpakete zur besagten Hauptstation (MC) zu transferieren, wobei ein Teil der besagten Zeitschlitze für den stromaufgerichteten Transfer von Daten von den besagten Anwenderstationen (U1/16) an die besagte Hauptstation (MC) zugeordnet ist, die die Bandbreiten betreffen, die für weiteren Transfer von stromaufgerichteten Datenpaketen durch diese Stationen erforderlich sind, wobei das besagte Zeitschlitz-Managementsystem (TSM) ein Aufzeichnungsmittel (R) für das Speichern von Angabewerten der besagten Bandbreiten für die besagten Anwenderstationen (U1/16) umfaßt, sowie ein Umwandlungs- und Übertragungsmittel (C) für die Umwandlung der besagten Werte in entsprechende Vorkommen von Identitäten in einem Strom von Stationsidentitäten und zur Übertragung des besagten Stroms von Identitäten in stromabgerichteten Datenpaketen an besagte Anwendersationen (U1/16), wobei jeder davon nach Entdeckung ihrer eigenen Identität in besagtem Strom ermöglicht wird, eine vorbestimmte Anzahl stromaufgerichteter Datenpakete zu übertragen, dadurch gekennzeichnet, daß die besagten stromabgerichteten Datenpakete eine vorbestimmte Anzahl Blöcke umfassen, von denen jeder einen Kopfzeilenteil (H1/4) und einen Datenteil (A1/4) enthält, wobei die Identität des besagten Stroms auf die Kopfzeilenteile (H1/4) der besagten Blöcke verteilt ist.

2. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 1, dadurch gekennzeichnet, daß jede der besagten Anwenderstationen (U1/16) nach Erhalt ihrer Identität während eines vorbestimmten Zeitintervalls wartet, der gleich der Zeit ist, die für eine Paketübertragung von der besagten Anwenderstation zu einer fiktiven Anwenderstation, die sich in maximaler Entfernung von der besagten Hauptstation (MC) befindet, erforderlich ist, und dann das besagte stromaufgerichtete Datenpaket unter Benutzung des n-ten folgenden Zeitschlitzes schickt, wobei n von der Reihenfolge des Auftretens der besagten Identität in besagtem Identitätsstrom ab-

hängt.

3. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 1, dadurch gekennzeichnet, daß es sich in besagter Hauptstation (MC) befindet.

4. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 1, dadurch gekennzeichnet, daß das besagte Umwandlungsmittel (C) umfaßt:

   - mehrere Zählermittel (TI/16), von denen jedes einer der besagten Anwenderstationen (U1/16) zugeordnet ist und eine Identität hat, die Angabewert der Identität der besagten Anwenderstation hat, wobei jedes Zählermittel (T1/16) einen Ausgang hat, an dem unter Steuerung des besagten Aufzeichnungsmittels (R) ein Auslösesignal generiert wird, wenn die entsprechende Anwenderstation Zugriff auf ihre einzelne Verbindungsleitung anfordern darf; und
   - ein Multiplexmittel (MUX), das die besagten Ausgänge erfolgreich prüft und, wenn das Auslösesignal an besagtem geprüftem Ausgang anliegt, die Identität des dem besagten Ausgang entsprechenden Zählermittels in besagten Strom einschließt.

5. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 4, dadurch gekennzeichnet, daß die besagten Zählermittel (T1/16) jeweils eine Zählerschaltung umfassen, die von besagtem Aufzeichnungsmittel gesteuert wird, um ab einem Höchstwert abwärtszuzählen, der auf dem besagten gespeicherten Wert beruht, oder aufwärtszuzählen ab einem Nullwert, bis zu besagtem Höchstwert.

6. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 1, dadurch gekennzeichnet, daß das besagte Zeitschlitz-Management ebenfalls umfaßt:

   - ein Wartereihemittel (Q) für die Wartereihe des besagten Identitätsstroms, und
   - ein Paketformatiermittel (F) für die Verteilung mehrerer der besagten Identitäten nach ihrer Gewinnung aus dem besagten Wartereihemittel auf die besagten Kopfzeilenteile (H1/4), wobei die besagte Mehrzähligkeit der besagten vorbestimmten Anzahl Blöcke entspricht.

7. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 1, dadurch gekennzeichnet, daß jeder der besagten Kopfzeilenteile (H1/4) 1 Byte lang ist, während die vorbestimmte Anzahl gleich 4 ist, Synchronisierungsdaten (CPA), wobei die Identität von 4 Anwenderstationen (TEA1/4) und die Fehlerprüfdaten (CRC) auf die 4 Kopfzeilen jedes der besagten stromabgerichteten Datenpakete verteilt werden.

8. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 1, dadurch gekennzeichnet, daß das besagte Kommunikationssystem ein optisches Rommunikationssystem ist.

9. Zeitschlitz-Managementsystem (TSM) gemäß Anspruch 1, dadurch gekennzeichnet, daß jedes der besagten stromaufgerichteten Datenpakete und der besagten Datenteile (A1/4) mindestens eine Asynchronous Transfer Mode Zelle umfaßt (Asynchroner Transfermode).

Revendications

1. Système de gestion de tranches de temps (TSM) pour un système à accès multiple par répartition dans le temps numérique comportant une station principale (MC) couplée à chaque sous-station d'une pluralité de sous-stations (U1/16) par l'intermédiaire de la connexion en cascade d'une liaison de transmission commune (lc) et d'une liaison utilisateur individuelle (I1/16), ledit système de gestion (TSM) permettant à chacune des sous-stations de la pluralité de sous-stations (U1/16) de transférer des paquets d'informations en amont à ladite station principale (MC) dans des tranches de temps, une partie desdites tranches de temps étant consacrée au transfert, en amont, entre lesdites stations utilisateur (U1/16) et ladite station principale (MC), d'informations qui concernent la largeur de bande requise pour un autre transfert de paquets d'informations en amont par ces stations, ledit système de gestion de tranches de temps (TSM) comportant un moyen d'enregistrement (R) permettant de mémoriser lesdites valeurs de stations utilisateur (U1/16) qui indiquent ladite largeur de bande et un moyen de conversion et de transmission (C) permettant de convertir lesdites valeurs en des occurrences correspondantes d'identifiants dans un train d'identifiants de stations et de transmettre ledit train d'identifiants dans des paquets d'informations en aval auxdites stations utilisateur (U1/16), chacune d'elles, après détection de son propre identifiant dans ledit train, pouvant transférer une quantité prédéterminée de paquets d'informations en amont, caractérisé en ce que lesdits paquets d'informations en aval comportent un nombre prédéterminé de blocs, chacun comportant une partie en-tête (H1/4) et une partie d'informations (A1/4), les identifiants desdits trains étant répartis dans les parties en-tête (H1/4) desdits blocs.

2. Système de gestion de tranches de temps (TSM) selon la revendication 1, caractérisé en ce que chacune desdites stations utilisateur (U1/16), après réception de son identifiant, attend pendant un intervalle de temps prédéterminé égal au temps néces-

saire pour transférer un paquet entre ladite station utilisateur et une station utilisateur fictive située à la distance maximum de ladite station principale (MC) puis transmet ledit paquet d'informations en amont en utilisant la nième tranche de temps suivante, n étant déterminé par l'ordre d'occurrence dudit identifiant dans ledit train d'identifiants.

3. Système de gestion de tranches de temps (TSM) selon la revendication 1, caractérisé en ce qu'il est situé dans ladite station principale (MC).

4. Système de gestion de tranches de temps (TSM) selon la revendication 1, caractérisé en ce que ledit moyen de conversion (C) comporte :

   - une pluralité de moyens formant compteurs (T1/16), chacun étant consacré à l'une desdites stations utilisateur (U1/16) et présentant un identifiant indiquant l'identifiant de ladite station utilisateur, chaque moyen formant compteur (T1/16) présentant une sortie au niveau de laquelle, sous la commande dudit moyen d'enregistrement (R), un signal de déclenchement est généré lorsque la station utilisateur correspondante est autorisée à demander un accès à sa liaison utilisateur individuelle ; et
   - un moyen de multiplexage (MUX) permettant d'analyser successivement lesdites sorties et lorsque ledit signal de déclenchement est présent au niveau de ladite sortie analysée, d'inclure dans ledit train l'identifiant du moyen formant compteur correspondant à ladite sortie.

5. Système de gestion de tranches de temps (TSM) selon la revendication 4, caractérisé en ce que ledit moyen formant compteur (T1/16) comporte un circuit de compteur qui est commandé par ledit moyen d'enregistrement pour effectuer un compte à rebours qui commence à une valeur maximum fondée sur ladite valeur mémorisée ou à compter dans l'ordre croissant à partir d'une valeur nulle jusqu'à atteindre ladite valeur maximum.

6. Système de gestion de tranches de temps (TSM) selon la revendication 1, caractérisé en ce que ledit système de gestion de tranches de temps comporte également :

   - une moyen de mise en file d'attente (Q) permettant de mettre en file d'attente ledit train d'identifiants ; et
   - un moyen de formatage de paquets (F) permettant de distribuer une pluralité desdits identifiants, après récupération dans ledit moyen de mise en file d'attente, sur lesdites parties d'entête (H1/4), ladite pluralité correspondant audit nombre prédéterminé de blocs.

7. Système de gestion de tranches de temps (TSM) selon la revendication 1, caractérisé en ce que chacune des parties en-tête (H1/4) présente une longueur d'un octet, alors que ledit nombre prédéterminé égale 4, les informations de synchronisation (CPA), l'identifiant des 4 stations utilisateur (TEA1/4) et les informations de contrôle d'erreurs (CRC) étant distribués sur les 4 entêtes de chacun desdits paquets d'informations en aval.

8. Système de gestion de tranches de temps (TSM) selon la revendication 1, caractérisé en ce que ledit système de communication est un système de communication optique.

9. Système de gestion de tranches de temps (TSM) selon la revendication 1, caractérisé en ce que chacun desdits paquets d'informations en amont et chacune desdites parties d'informations (A1/4) comportent au moins une cellule en mode de transfert asynchrone.

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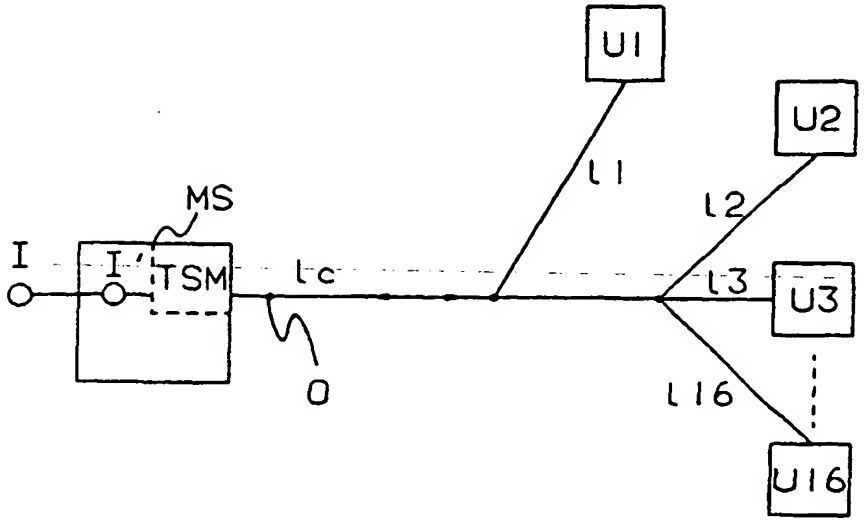

FIG. 1

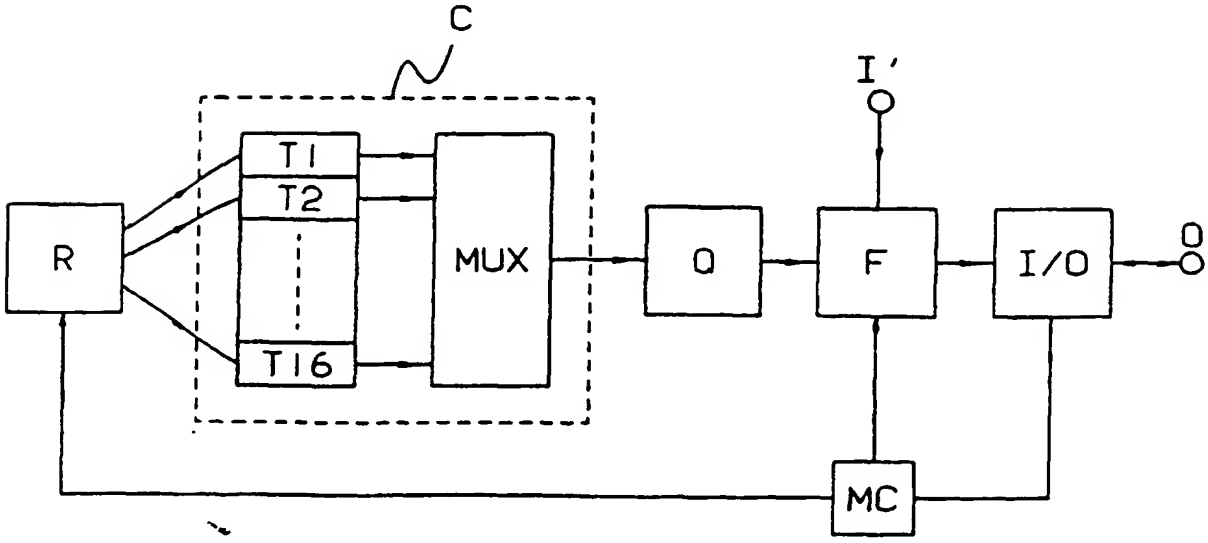

FIG. 2

TSM

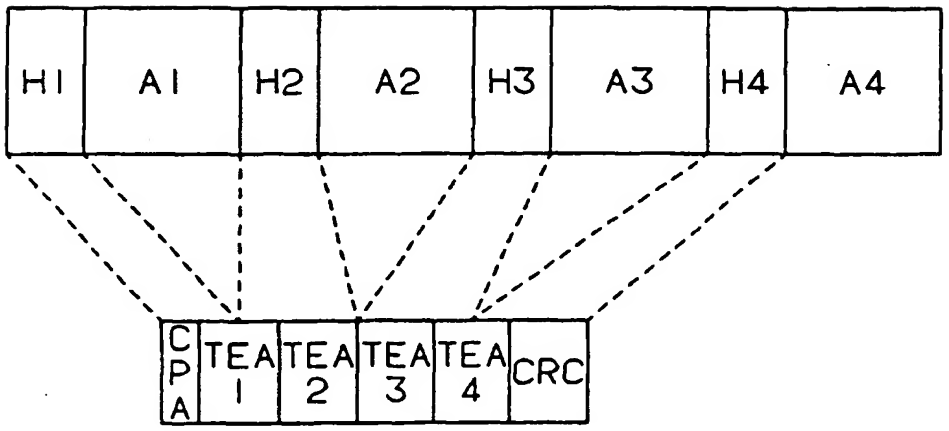

FIG.3